

T01D05 – Gas Laws**GAS LAWS**Boyle's: $P_1V_1 = P_2V_2$ Charles's: $V_1/T_1 = V_2/T_2$ Combined: $P_1V_1/T_1 = P_2V_2/T_2$ Ideal: $PV = nRT$ $n = g/MM$ **Constants**

$$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$$

$$R = 8.31 \frac{L \cdot kPa}{mol \cdot K}$$

Name.....

Formulas

$$K = ^\circ C + 273.15$$

Dalton's Law of Partial P's:

$$P_T = P_1 + P_2 + P_3 + P_n \dots$$

Mole fraction:

Mole fraction of any system is the moles of that substance divided by the total number of moles.

[$X = n_A/n_T$ where X is the mole fraction; n_A = moles of a component; n_T = total moles in the system]**Standards:**Pressure: 1 atm = 760 mm Hg = 101.35 kPa = 1.0135×10^5 Pa = 760 torr = 14.7 lbs/in² = 29.92 in. Hg

Temperature: 0.0 °C = 273 K

- When hydrogen sulfide gas, H₂S, reacts with oxygen, sulfur dioxide and steam are produced.
 - Write a balanced equation for the reaction.
 - How many liters of sulfur dioxide gas are formed from 16 grams of oxygen gas? [Assume STP conditions]
 - How many liters of sulfur dioxide would be produced from 4.0 L of oxygen gas? How many liter of steam would be produced? [Assume that all gases are at the same temperature and pressure.]
- Calcium reacts with water yielding hydrogen gas and calcium hydroxide. How many mL of water ($d = 1.00 \text{ g cm}^{-3}$) are required to produce 7.00 L of hydrogen gas at 758 mm Hg and 29.5 degrees C?
- Suppose exhaled air is at a pressure of 751 mm Hg. Calculate the partial pressures of nitrogen, oxygen, carbon dioxide, and water vapor. The mole percent of these gases in exhaled air is 74.5% nitrogen, 15.7% oxygen, 3.6% carbon dioxide, and 6.2% water

4. A gaseous mixture contains 5.78 grams of methane, CH_4 , 2.15 grams of neon, 6.80 grams of sulfur dioxide, and 2.22 grams of hydrogen. Calculate the mole fraction of each gas.
- (a) What is the total pressure exerted by these gases when they are all placed inside a 55.0 L cylinder at 85.0 degrees C?
- (b) What is the partial pressure that each gas exerts?
- i. Calculate the mole fraction of each of the gases:
5. Calculate the mole fraction of each gas if the system contains 12.0 grams of oxygen gas, 21.5 grams of hydrogen gas, and 123.5 grams of krypton gas. [Assume no chemical reaction occurs]
6. Calculate the mole fraction of each gas in a system if it contains 23.5 grams of chlorine gas, 15.0 grams of fluorine gas, and 26.0 grams of helium gas. [Assume no chemical reaction occurs]
7. What is the pressure in atmospheres of a gas mixture that contains 1.0 grams of hydrogen, and 8.0 grams of argon in a 3.0 L container at 27.0 degrees C?
8. 1.55 L of oxygen gas are collected at -5.0 degrees C and a pressure of 28.96 inches Hg . What is the volume of the gas at standard conditions?

9. A gas occupying 35.0 mL at 20.0 degrees C and a pressure of 775 mm Hg is cooled until it reaches -45 degrees C while the pressure remains constant. What is the new volume of the gas?
10. A gas has a pressure of 0.970 atm at 38.5 degrees C. What is its pressure at standard temperature?
11. What is the volume of 55.5 grams of hydrogen gas at a temperature of 23.5 degrees C and a pressure of 756.5 mm Hg?
12. 5.55 grams of oxygen gas are at a pressure of 2.55 atm and a temperature of 110 degrees C occupies what volume?
13. A gas at 25.0 degrees C has a volume of 55.5 cm³. What is the new temperature if the volume has changed to 111 cm³?
14. A sample of oxygen gas at 22.5 degrees C and a pressure of 720 mm Hg occupies a volume of 1.55 L. What is the new temperature if the pressure has been changed to 765 mm Hg, and the volume is now 0.75 L?
15. What is the temperature of 12.0 grams of neon gas that is placed into a container having a volume of 75.0 mL and a pressure of 355 mm Hg?
16. What is the original volume of a gas at -10 degrees C if when the temperature is changed to 12.0 degrees C the new volume is 1.65 L?

17. 25.0 grams of sulfur dioxide occupy a volume of 225 mL at a temperature of 15.0 degrees C and a pressure of 755 mm Hg. What is its new volume at standard conditions?